# The influence of light armour vests on police officer's perception and performance of occupational tasks

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# The effect of light armour systems on the power development, agility, balance and movement of police officers.

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## Background

The wearing of Individual Light Armour Vests (ILAVs) by police officers is increasing with this requirement being due to occupational hazards including blunt trauma, stabbing and light calibre bullets[1].

Despite studies showing the detrimental effects of military styled body armour[2], minimal research exists on lighter, specifically designed police armour systems.

It is unclear how addition of this extra load will affect the officer's mobility, movement, balance ability and therefore subsequent injury risk and return-to-work requirements.

## Purpose

The aim of this investigation was to determine the effects of three different ILAVs on the power, agility, balance and movement of police officers when compared to wearing their normal station wear.


## Methods

A prospective, repeated measures, study was performed with each officer (n=11) wearing one of three different types of ILAVs (ILAV A-C weight 3.24±0.48 - 4.12±0.65kg) or normal station wear (N) each for an entire day.

The officers were assessed for their ability to generate power with a vertical jump (VJ), a Counter Movement Jump (CMJ) and a 20m sprint, for change of direction ability with the Illinois Agility Test, for postural sway using a force plate, and for structural movement ability with the Functional Movement Screen (FMS).

## Results

There were no significant differences between any of the ILAVs in VJ height, time to complete the agility test, 20 m sprint time, and in the peak force, velocity, power or jump height in the CMJ (Table 1).

There was a significantly ($p<.05$) higher mean force produced in the CMJ while wearing all three ILAVs.

There were no significant differences in any of the balance measures between any of the ILAV or N load conditions at any time of day.

Significant differences were found between various components of the FMS, including (R) Straight Leg Raise, (L) Shoulder Mobility and both (R) and (L) quad rotary stability.

Table 1: Results for each of the various ILAVs compared to normal station wear (N)

| Measure | ILAV A | ILAV B | ILAV C | N |
|---|---|---|---|---|
| ILAV Weight (kg) | 4.12 ± 0.65* | 3.54 ± 0.70* | 3.24 ± 0.48* | - |
| Duty Load (kg) | 11.53 ± 0.77** | 11.01 ± 1.01** | 10.77 ± 1.16** | 8.69 ± 0.68 |
| Balance Average Sway Velocity (deg/sec) | 0.507 ± 0.090 | 0.503 ± 0.086 | 0.512 ± 0.083 | 0.479 ± 0.080 |
| Balance ML Total Distance (m) | 0.079 ± 0.016 | 0.085 ± 0.019 | 0.085 ± 0.013 | 0.079 ± 0.011 |
| Balance AP Total Distance (m) | 0.083 ± 0.014 | 0.085 ± 0.016 | 0.085 ± 0.018 | 0.076 ± 0.014 |
| Balance Total Excursion Area (sq/cm) | 2.42 ± 0.87 | 2.60 ± 0.99 | 3.01 ± 1.19 | 2.49 ± 0.84 |
| FMS Shoulder Mobility Right (/3) | 1.73 ± 0.65* | 1.91 ± 0.83* | 2.00 ± 0.78* | 2.36 ± 0.81 |
| FMS Quad Rotary Stability Left (/3) | 1.18 ± 0.41* | 1.18 ± 0.41* | 1.09 ± 0.30* | 1.55 ± 0.52 |
| FMS Quad Rotary Stability Right (/3) | 1.27 ± 0.47* | 1.27 ± 0.47* | 1.27 ± 0.47* | 1.91 ± 0.30 |
| FMS Total Score (/21) | 12.09 ± 2.74 | 11.64 ± 2.01 | 11.45 ± 1.51 | 12.64 ± 2.16 |
| Vertical Jump AM (cm) | 33.81 ± 7.06 | 32.82 ± 6.69 | 34.18 ± 6.72 | 34.55 ± 7.24 |
| Vertical Jump PM (cm) | 34.91 ± 7.50 | 35.27 ± 7.09 | 36.00 ± 9.30 | 36.91 ± 8.34 |
| Agility (s) | 21.11 ± 2.12 | 21.11 ± 1.91 | 20.61 ± 2.04 | 21.04 ± 2.57 |
| 20m Sprint (s) | 4.02 ± 0.30 | 3.98 ± 0.33 | 3.97 ± 0.48 | 3.95 ± 0.36 |
| CMJ Mean Force (N) | 867 ± 200* | 863 ± 200* | 859 ± 199* | 840 ± 197 |
| CMJ Peak Force (N) | 3649.70 ± 1120.74 | 3704.40 ± 1189.79 | 3493.75 ± 1077.35 | 3460.49 ± 1407.79 |
| CMJ Peak Velocity (m/s) | 1.49 ± 0.23 | 1.53 ± 0.22 | 1.50 ± 0.27 | 1.49 ± 0.25 |
| CMJ Peak Power (W) | 2401.85 ± 943.79 | 2423.47 ± 918.45 | 2379.26 ± 976.85 | 2379.60 ± 983.36 |
| CMJ Peak Jump (m) | 0.32 ± 0.11 | 0.35 ± 0.13 | 0.34 ± 0.12 | 0.35 ± 0.15 |

*Significantly different to normal station wear ($p<0.05$) **= Significantly more ($p<0.001$) than normal station wear (N)


## Discussion

The ILAVs investigated do not appear to be heavy enough to significantly affect the power, change of direction ability or balance of police officers when compared to normal station wear.

It appears as though body armour can significantly affect police officer mobility as measured by the FMS and therefore may contribute to injury risk.

## Implications

The wearing of ILAVs by police officers does not appear to hinder policing tasks that involve agility or rapid power development any more than normal station wear. Body armour should be carefully selected to ensure it does not contribute to injury risk nor detract from occupational performance and should be considered in return-to-work planning.

## References

[1]Schram, B., Hinton, B., Orr, R., Pope, R., & Norris, G. (2018). The Perceived Effects and Comfort of Various Body Armour Systems on Police Officers while Performing Occupational Tasks. Annals of Occupational and Environmental Medicine, 30(15).

[2]Orr, R., Schram, B., & Pope, R. (2018). A comparison of military and law enforcement body armour. International Journal of Environmental Research and Public Health, 15(2). doi:10.3390/ijerph15020339